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USER MANUAL

Digital indicator with relay outputs

PMS-920/I/Z

firmware version: x.02 or higher

CE

Read the user's manual carefully before starting to use the unit.
Producer reserves the right to implement changes without prior notice.

Warsaw 22.06.2006

V.1.0

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Explanation of symbols used in the manual:

- This symbol denotes especially important guidelines concerning the installation and operation of the device. Not complying with the guidelines denoted by this symbol may cause an accident, damage or equipment destruction.

IF THE DEVICE IS NOT USED ACCORDING TO THE MANUAL THE USER IS RESPONSIBLE FOR POSSIBLE DAMAGES.

- This symbol denotes especially important characteristics of the unit. Read any information regarding this symbol carefully

1. BASIC REQUIREMENTS AND USER SAFETY

- **The manufacturer is not responsible for any damages caused by inappropriate installation, not maintaining the proper technical condition and using the unit against its destination.**
- Installation should be conducted by qualified personnel . During installation all available safety requirements should be considered. The fitter is responsible for executing the installation according to this manual, local safety and EMC regulations.
- The unit must be properly set-up, according to the application. Incorrect configuration can cause defective operation, which can lead to unit damage or an accident.
- **If in the case of a defect of unit operation there is a risk of a serious threat to the safety of people or property additional, independent systems and solutions to prevent such a threat must be used.**
- **The unit uses dangerous voltage that can cause a lethal accident. The unit must be switched off and disconnected from the power supply prior to starting installation of troubleshooting (in the case of malfunction).**
- Neighbouring and mating equipment must meet the requirements of appropriate standards and regulations concerning safety and be equipped with adequate anti-overvoltage and anti-interference filters.
- **Do not attempt to disassemble, repair or modify the unit yourself. The unit has no user serviceable parts. Units, in which a defect was stated must be disconnected and submitted for repairs at an authorized service centre.**

- In order to minimize fire or electric shock hazard, the unit must be protected against atmospheric precipitation and excessive humidity.
- Do not use the unit in areas threatened with excessive shocks, vibrations, dust, humidity, corrosive gasses and oils.
- Do not use the unit in explosion hazard areas.

- Do not use the unit in areas with significant temperature variations, exposed to condensation or icing.
- Do not use the unit in areas exposed to direct sunlight.
- Make sure that the ambient temperature (e.g. inside the control box) does not exceed the recommended values. In such cases forced cooling of the unit must be considered (e.g. by using a ventilator).

The unit is designed for operation in an industrial environment and must not be used in a household environment or similar.

2. GENERAL CHARACTERISTICS

The **PMS-920/I/Z** controller is equipped with one measurement input (current input) with user selected range 0-20mA or 4-20mA and a standard resistor protection circuit. Displayed values range can be selected by user, from -999 to 9999, plus decimal point. Additionally the **PMS-920/I/Z** allows user to select a conversion characteristic of several kinds: linear, square, square root, and user defined (max.20 points length). The device is equipped with sensor supply output and one (or two) relay outputs which can be loaded max. 1A/250V. Optionally **PMS-920/I/Z** can be equipped with RS 485 interface. The controller can be ordered in two power supply versions. The device has 4 buttons being used for main presets programming.

PMS-920/I/Z can be used for controlling and regulation of processes need proportional and threshold control like: temperature processes (heating or cooling), valves controlling or other.

3. TECHNICAL DATA

Power supply voltage	230 V AC ± 10%; 50 ÷ 60 Hz
(depending on version)	24 V DC (not separated)
External fuse (required)	T - type, max. 2 A
Power consumption	max. 1,5 VA @ 230V AC max. 3,5 W @ 24V DC
Measurement input	
current range:	0÷20 mA, 4÷20 mA overload protected, maximum input current about 35 mA
measurement input resistance:	100 Ω
accepted prolonged input overload:	20%
Outputs	
relay:	1 or 2 NO, 1A/250V AC (cos φ = 1)
sensor power supply:	21V DC ± 5V / max. 25 mA (100 mA for 24V DC power supply), not stabilized, not separated from measurement inputs
Display range	-999 ÷ 9999, plus decimal point
Current measurement accuracy	± 0,25% ± one digit (for 0÷20 mA range)
Communication interface (optional)	RS 485, 8N1 / Modbus RTU, not separated
Baud rate	1200 bit/s ÷ 19200 bit/s

Display (depending on version)	Standard version: LED, 4 digit, 20mm height, red IP 65 version: 5 digit, 9mm height, red
Protection level	IP 65 (from front, after using waterproof cover) IP 40 (from front) IP 20 (housing and connection clips)
Housing type	panel
Housing material	NORYL - GFN2S E1
Housing dimensions	72 x 36 x 97 mm
Panel cutout	66,5 x 32,5 mm
Assembly depth	102 mm
Panel thickness	max. 5 mm
Operating temperature	0°C to +50°C
Storage temperature	-10°C to +70°C
Humidity	5 to 90% no condensation
Altitude	up to 2000 meters above sea level
Screws tightening max. torque	0,5 Nm
Max. connection leads diameter	2,5 mm^2
Safety requirements	according to: PN-EN 61010-1:1999 + PN-EN 61010-1/A2:1999 installation category: II pollution degree: 2 voltage in relation to ground: 300V AC insulation resistance: >20MΩ insulation strength between power supply and input/output terminal: 1min. @ 2300V insulation strength between relays terminal: 1min. @ 1350V
EMC	PN-EN 61326:2003

This is a class A unit. In housing or a similar area it can cause radio frequency interference. In such cases the user can be requested to use appropriate preventive measures.

4. DEVICE INSTALLATION

The unit has been designed and manufactured in a way assuring a high level of user safety and resistance to interference occurring in a typical industrial environment. In order to take full advantage of these characteristics installation of the unit must be conducted correctly and according to the local regulations.

- Read the basic safety requirements on page 3 prior to starting the installation.
- Ensure that the power supply network voltage corresponds to the nominal voltage stated on the unit's identification label.
- The load must correspond to the requirements listed in the technical data.
- All installation works must be conducted with a disconnected power supply.
- Protecting the power supply clamps against unauthorized persons must be taken into consideration.

4.1. UNPACKING

After removing the unit from the protective packaging, check for transportation damage. Any transportation damage must be immediately reported to the carrier. Also, write down the unit serial number on the housing and report the damage to the manufacturer.

Attached with the unit please find:
- assembly brackets - 2 pieces,
- warranty,
- user's manual for **PMS-920/I/Z** unit (device)

4.2. ASSEMBLY

- The unit is designed for mounting indoor inside housings (switchbox, switchboard) assuring appropriate protection against electric impulse waves. Metal housing must be connected to the grounding in a way complying with the governing regulations.
- Disconnect the power supply prior to starting assembly.
- Check the correctness of the performed connections prior to switching the unit on.

In order to assembly the unit, a 66,5 x 32,5 mm panel cutout (Figure 4.1) must be prepared. The thickness of the material of which the panel is made must not exceed 5mm. When preparing the cutout take the grooves for catches located on both sides of the housing into consideration (Figure 4.1). Place the unit in the cutout inserting it from the front side of the panel, and then fix it using the brackets (Figure 4.2). The minimum distances between assembly holes' axes - due to the thermal and mechanical conditions of operation - are 91 mm x 57mm (Figure 4.3).

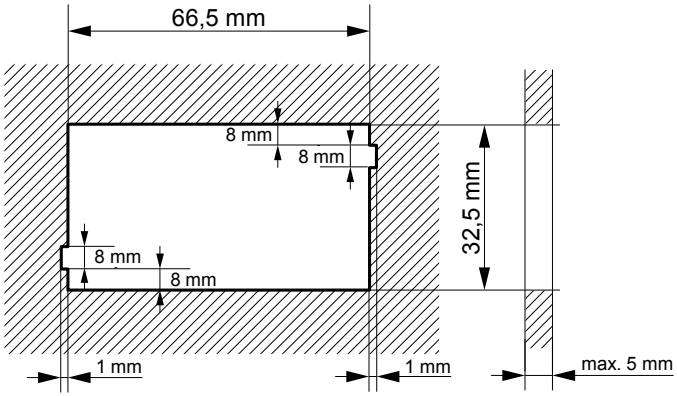


Figure 4.1. Panel cutout dimensions

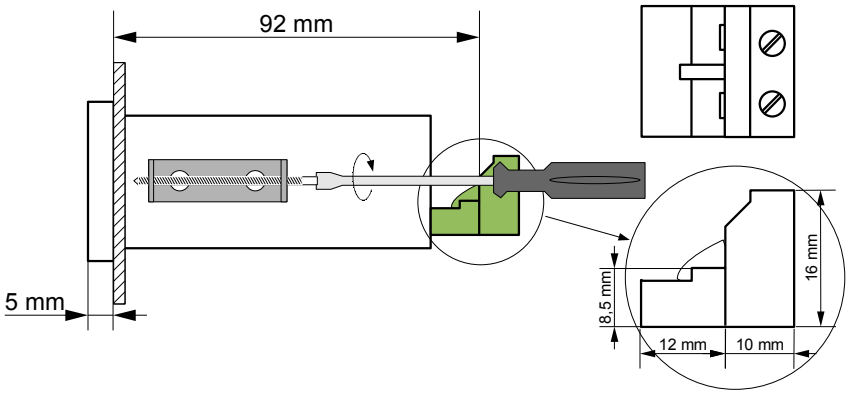


Figure 4.2. Installing of brackets, and dimensions of connectors.

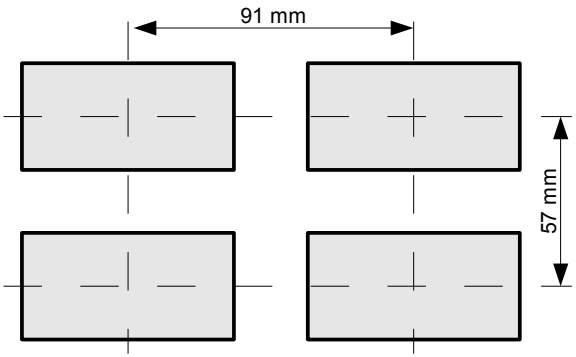


Figure 4.3. Minimum distances between axes of devices when assembly of a number of units

4.3. CONNECTION METHOD

Caution

- Installation should be conducted by qualified personnel . During installation all available safety requirements should be considered. The fitter is responsible for executing the installation according to this manual, local safety and EMC regulations.

- The unit is not equipped with an internal fuse or power supply circuit breaker. Because of this an external time-delay cut-out fuse with minimal possible nominal current value must be used (recommended bipolar, max. 2A) and a power supply circuit-breaker located near the unit. In the case of using a monopolar fuse it must be mounted on the phase cable (L).

- The power supply network cable diameter must be selected in such a way that in the case of a short circuit of the cable from the side of the unit the cable shall be protected against destruction with an electrical installation fuse.

- Wiring must meet appropriate standards and local regulations and laws.

- In order to secure against accidental short circuit the connection cables must be terminated with appropriate insulated cable tips.

- Tighten the clamping screws. The recommended tightening torque is 0.5 Nm. Loose screws can cause fire or defective operation. Over tightening can lead to damaging the connections inside the units and breaking the thread.

- In the case of the unit being fitted with separable clamps they should be inserted into appropriate connectors in the unit, even if they are not used for any connections.

- Unused clamps (marked as n.c.) must not be used for connecting any connecting cables (e.g. as bridges), because this can cause damage to the equipment or electric shock.

- If the unit is equipped with housing, covers and sealing packing, protecting against water intrusion, pay special attention to their correct tightening or clamping. In the case of any doubt consider using additional preventive measures (covers, roofing, seals, etc.). Carelessly executed assembly can increase the risk of electric shock.

- After the installation is completed do not touch the unit's connections when it is switched on, because it carries the risk of electrical shock.

Due to possible significant interference in industrial installations appropriate measures assuring correct operation of the unit must be applied. To avoid the unit of improper indications keep recommendations listed below.

- Avoid common (parallel) leading of signal cables and transmission cables together with power supply cables and cables controlling induction loads (e.g. contactors). Such cables should cross at a right angle.
- Contactor coils and induction loads should be equipped with anti-interference protection systems, e.g. RC-type.
- Use of screened signal cables is recommended. Signal cable screens should be connected to the earthing only at one of the ends of the screened cable.
- In the case of magnetically induced interference the use of twisted couples of signal cables (so-called “spirals”) is recommended. The spiral (best if shielded) must be used with RS-485 serial transmission connections.
- In the case of interference from the power supply side the use of appropriate anti-interference filters is recommended. Bear in mind that the connection between the filter and the unit should be as short as possible and the metal housing of the filter must be connected to the earthing with largest possible surface. The cables connected to the filter output must not run in parallel with cables with interference (e.g. circuits controlling relays or contactors).

Connections of power supply voltage and measurement signals are executed using the screw connections on the back of the unit’s housing (Figure 4.4 - 4.6).

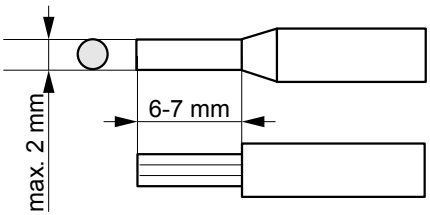


Figure 4.4. Method of cable insulation replacing and cable terminals

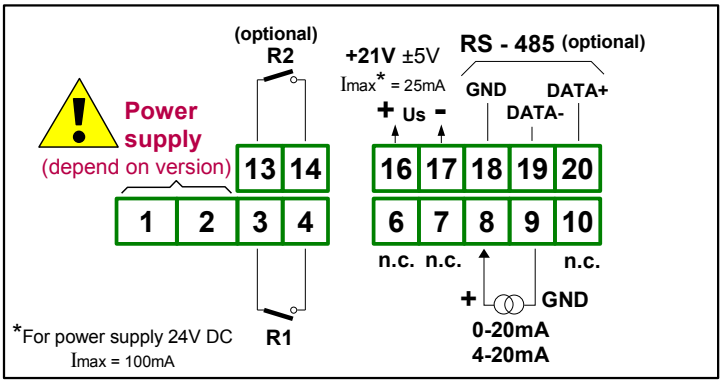


Figure 4.5. Terminals description

All connections must be made while power supply is disconnected !

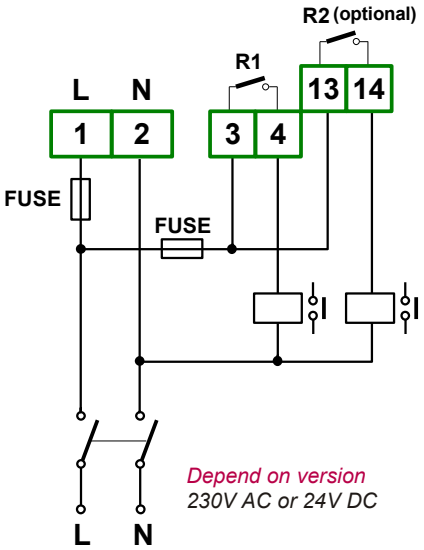


Figure 4.6. Connection of power supply and relays

4.4. MAINTENANCE

The unit does not have any internal replaceable or adjustable components available to the user. Pay attention to the ambient temperature in the room where the unit is operating. Excessively high temperatures cause faster ageing of the internal components and shorten the fault-free time of unit operation.
In cases where the unit gets dirty do not clean with solvents. For cleaning use warm water with small amount of detergent or in the case of more significant contamination ethyl or isopropyl alcohol.

Using any other agents can cause permanent damage to the housing.

Product marked with this symbol should not be placed in municipal waste. Please check local regulations for disposal and electronic products.

5. FRONT PANEL DESCRIPTION

Symbols and functions of pushbuttons

Symbol used in the manual: **[ESC/MENU]**
Functions:
- Enter to main menu (press and hold by at least 2 sec.)
- Exit the current level and Enter to previous menu (or measure mode)
- Cancel the changes made in parameter being edited

Symbol used in the manual: **[ENTER]**
Functions:
- Start to edit the parameter
- Enter to the sub-menu,
- Confirmation of changes made in parameter being edited

Symbol used in the manual: **[^] [v]**
Functions:
- Change of the present menu,
- Modification of the parameter value,
- Change of the display mode.

6. PRINCIPLE OF OPERATION

After turning the power supply on, device ID and software version are showed on the display, next the controller goes to the measurement mode.

6.1. MEASUREMENT MODE

In the measure mode, the measurement results, converted over selected characteristic, are displayed on the display. The measurement range equal to the nominal range is called: ***nominal measurement range,*** and the measurement range equal to the extended nominal range is called: ***permissible measurement range*** (Figure 6.1, 6.2).

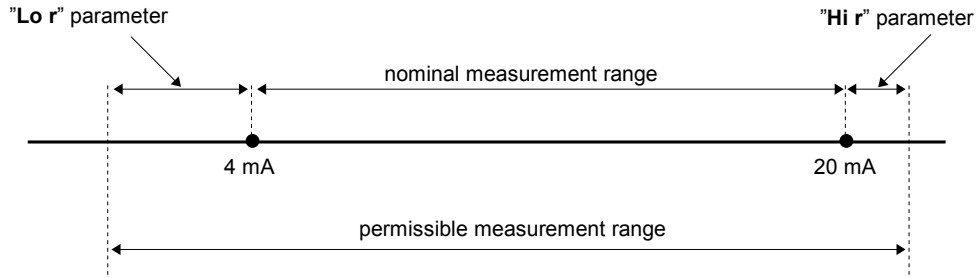


Figure 6.1. Definitions of measurement ranges in mode 4 ÷ 20mA

If the result of measurement exceeds the ***permissible measurement range***, **AL** diode lights and warning **"-Hi-"** or **"-Lo-"** is displayed rather than input signal, depends on exceeded value (see description of **"Lo r"** i **"Hi r"** parameters, paragraph ***"inPt" menu***). The warning can be effect of measurement circuit malfunction. In that case **"-Lo-"** means shortcut and **"-Hi-"** means break of measurement circuit.

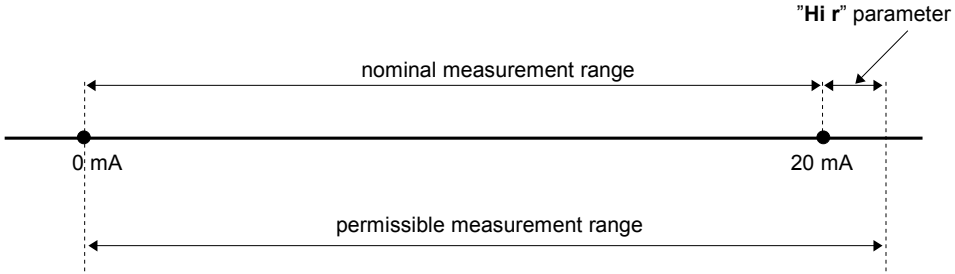


Figure 6.2. Definitions of measurement ranges in mode 0 ÷ 20mA

In the measurement mode user can check main thresholds values. After pressing **[^]** or **[v]** button, name of the threshold (**"rEL1"** or **"rEL2"**) and his value will be displayed on the display in alternating mode. If **[^]** or **[v]** will be pressed in 5 sec again, the next threshold will be displayed, else the device comes back to the measurement mode. If a ***free access*** is enabled (parameter **"AccE"** = on), user can change the value of particular threshold pressing button **[ENTER]** (see: ***PARAMETERS EDITION***).

Input type, range of displaying values, characteristic of conversion, decimal point position and measure filtering ratio, are user configurable parameters. All accessible parameters can be changed by entering the menu (see: ***DEVICE PROGRAMMING***). Use the local keyboard or the remote controller to do it. (Note: all parameters can be remote changed via RS-485 interface).

Configuration of the device (via menu or RS 485 interface) **do not stops measures**.

6.2. CONTROL OF THE RELAY OUTPUTS

The control of the object (measured signal) is realized via relay outputs. Front panel LEDs named „**R**" indicates the state of particular relay output.

If device is not equipped with one or more relay outputs, menus refer to this relays are available, but apply to LED indicators only. In such case LEDs indicates exceeding of particular thresholds.

Modes of the control can be changed depend on the values of parameters **"SEtP"**, **"SEt2", "HYSt"**, **"modE"**, **"t on"**, **"toFF"**, **"unit"** and **"AL".** Depend on **"modE"** parameter, relays can be not used or controlled over one or two thresholds values.

If one threshold is used (Figure 6.3) the relay can be turned on (**"modE" = "on"**) or off (**"modE" = "oFF"**) when the input signal value is contained in ***zone A.***

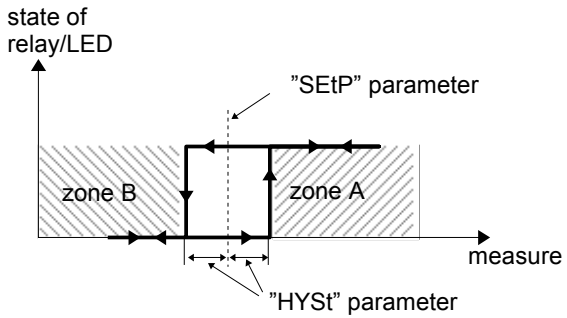
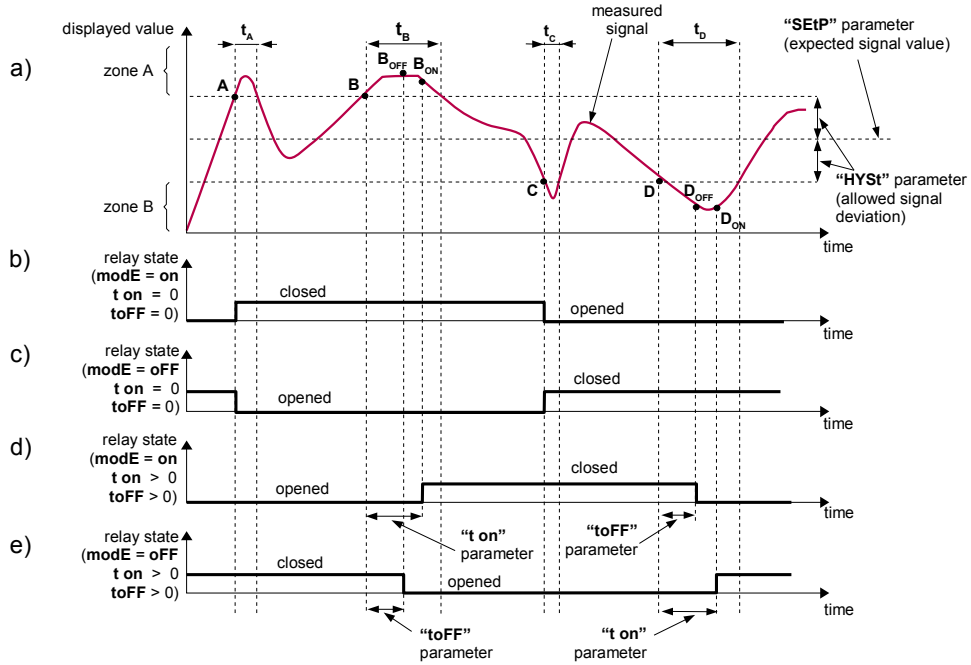


Figure 6.3. One threshold control of the relay outputs and LEDs R1÷R4

6.2.1. One threshold mode

Figure 6.4 presents the principle of relay outputs operation for one threshold mode, and an example values of other parameters.



Description:

A, B, C, D - points where measured signal exceeds border values (expected value ± allowed deviation)

B_{ON} ,B_{OFF} ,D_{ON} ,D_{OFF} - relays state changes moments: (for **"t on"** > 0, **"toFF"** > 0)

t_A , t_B , t_C , t_D , - time periods while input signal is in zone A or zone B

Figure 6.4. Principle of LED/relay output operation for one threshold mode

Parameter **"SetP"** sets a **threshold** of the relay, and parameter **"HYSt"** sets a **hysteresis** of the relay (Figure 6.4 a). The relay can change his state **only** when input value exceeds (over or under) ***border value*** and t_A ,t_B ,t_C ,t_D times (Figure 6.4) are bigger than the time defined by parameters **"t on"**, **"toFF"** and **"unit"**. ***Border values*** means values equal ***threshold+hysteresis*** and ***threshold-hysteresis*** respectively.

If **"t on"** and **"toFF"** parameters are set to "0", then the relay state will be changed **as soon** as input value exceeds any of the ***border values*** (see points A and C, Figure 6.4 a, b, c).

If values of **"t on"** or/and **"toFF"** are positive, then relay state will be turned on if the input value exceeds the ***border values*** and stay bigger (or lower) during at least **"t on"** (see points B_{ON}, D_{ON}, Figure 6.4 a, d, e). Similarly, the relay will be turned off if time **"toFF"** elapse since the input signal value exceeds any of the ***border values*** (see points B_{OFF}, D_{OFF}, Figure 6.4 a, d, e).

If t_A ,t_B ,t_C or t_D (when input signal stay in ***zone A*** or ***zone B***) are lower than parameters **"t on"** or **"toFF"**, the relay will not change his state (see points A and C, Figure 6.4 a, d, e).

The state of relay output while the input value exceeds the ***border values*** (points A, B, C, D) is described by parameter **"modE".** The relay can be turned on (**"modE" = "on"**), or turned off (**"modE" = "oFF"**) when input signal value is contained in ***zone A*** (Figure 6.4 a).

The parameter **"AL"** allow user to set the relay output behaviour in critical situations (e. g. Input values exceeds ***permissible measurement range***)***.*** User can select that the relays will be turned on, turned off,or not changed in critical situations.

All parameters connected with relay outputs are described in paragraph ***"rEL1", "rEL2" menu***.

7. DEVICE PROGRAMMING

The device menu allow user to set all parameters connected to operation of measurement input, control modes, critical situations behaviour, communication via RS-485 and access settings. The meaning of the particular parameters is described in paragraph ***MENU DESCRIPTION***.

Some of the parameters can be accessed without menu entering (quick view mode). After pressing **[^]** or **[v]** button, name of the threshold (**"rEL1"** or **"rEL2"**) and his value will be displayed on the display in alternating mode. If **[^]** or **[v]** will be pressed in 5 sec again, the next threshold will be displayed, else the device comes back to the measurement mode. If a ***free access*** is enabled (parameter **"AccE"** = on), user can change the value of particular threshold pressing button **[ENTER]** (see: ***PARAMETERS EDITION***).

If particular parameter has been changed and confirmed in quick view mode, its new value is displayed in alternating mode with parameter name by few seconds. Confirmed changes may be checked or user can switch viewed parameter pressing **[^]** or **[v]** button.

7.1. PROGRAMMING MENU

To enter main menu (being in the measurement mode) operator must to press and hold at least 2 sec. **[ESC/MENU]** button.

If the user password is defined (see parameter **"Scod"**, menu ***"SECU"***), operator have to enter correct one before proceeding to menu options . Entering of the passwords is similar to the edition of numeric parameters (see: ***PARAMETERS EDITION***), however presently editing digit is showed only on the display, other digits are replaced by "-" sign. After entering of last digit of the password first menu position will be displayed (if the password is correct) or warning "**Err**" in other case.

Pay attention when device parameters are being changed. If it is possible, turn off controlled installation (machine).

Functions of the buttons while sub-menu and parameters choice:

Selection of sub-menu or parameter for editing. Name of selected item (sub-menu or parameter) is displayed.

Operation of **[ENTER]** button depend on present menu position:

- if the name of some sub-menu is displayed - enter this sub-menu; name of the first parameter (or next level sub-menu) is displayed,
- if the name of some parameter is displayed - enter the edition of this parameter; present value of the parameter is displayed,

[ESC/MENU] button allow user to exit present menu level and goes to upper level menu (or measurement mode).

After about 1 min. since last use of the buttons, device exits the menu mode and returns to the measurement mode (only if no parameters are in editing mode).

7.2. PARAMETERS EDITION

To start edition of any parameter user should select name of desired one using **[^]** **[v]** buttons and then **[ENTER].**

7.2.1. Numeric parameters

Numeric parameters constitute a series of digits that form a number in decimal format. Entering a new parameter value consists of changing the values of selected digits within the allowable range (using the **[^]**, **[v]** keys). Some numeric parameters can take negative values). In such cases the "**-**" mark can be selected on the first decimal position of the parameter.

7.2.2. Switch parameters ("LIST" type)

Switch parameters can be described as a sets of values (a lists) out of which only one of the options available on the list can be selected for the given parameter. Options of switching parameter are selected using **[^]**, **[v]** keys.

Functions of buttons when editing numeric and switching parameters:

Change of current (flashing) digit value while editing numeric parameter, or value of switch parameter.

Pressing **[ENTER]** causes by switching edited digit or finishing of edition (if last digit or list-type parameter is edited). After that ask **"Set?"** is displayed. If **[ENTER]** is pressed again, than new value is stored in EEPROM, in other case changes are cancelled.

Pressing this button operator can cancel the changes done up to now (if they were not approved by **[ENTER]** button after the **"SEt?"** ask) and come back to menu

7.3. MENU DESCRIPTION

"- - - -" Password checking. If any password different from „**0000**" is set, than every enter to main menu follows the entering of password. If entered password is correct first menu position will be displayed else warning "**Err**", and unit returns to measurement mode.

Due to on 7 segment display it is impossible to show all ASCII symbols, some of them are exchanged by special symbols. For example the letter "m" is displayed as " ⊓ ". Although special symbols are used by the device, normal letters are used in instruction to made its easier to read (example: **"modE"**).

7.3.1. "rEL1" , "rEL2" menu

This menu contains options of configuration of operation of relays R1, R2. Principle of the relays operation is described in paragraph ***CONTROL OF THE RELAY OUTPUTS***.

If device is not equipped with one or more relay outputs, menus refer to this relays are available, but apply to LED indicators only. In such case LEDs indicates exceeding of particular thresholds.

"SEtP" - first threshold of the relay (range -999 ÷ 9999). Negative values can be input by selecting a "-" sign on first digit (to change value use **[^]** and **[v]** buttons). **Threshold is the medium value of relay hysteresis.**

"HYSt" - Hysteresis of relay (range 0 -999). Full hysteresis of the relay is equal to 2x **"HYSt"** parameter. The relay state can change when an input signal is out of **threshold-hysteresis** to **threshold+hysteresis** zone.

Presented parameters should be set to ensure that **SEtP** + **HYSt** and **SEtP - HYSt** do not exceeds the measure range.

"modE" - relay operation mode:

"noAC" - the relay is not active (permanent turned off)
"on" - the relay is turned **ON** when input signal exceeds **SEtP** + **HYSt** value**,** and is turned off back when the input signal became lower than **SEtP – HYSt**,

"oFF" - the relay is turned **OFF** when input signal exceeds **SEtP** + **HYSt** value**,** and is turned on back when the input signal became lower than **SEtP – HYSt**,

"modb" - the relay is controlled via RS-485 interface, independently on the input signal.

- **LEDs light when relays are closed**, independently of relays' mode.
- When power supply decay, unit do not store relays state selected by RS 485 interface.

"t on" - turn on delay time, the relay is turned on with delay equal **"t on"** if the input value exceeds appropriate ***border value*** (defined with ***threshold*** and ***hysteresis***), at least **"t on"** time. **"t on"** range 0 ÷ 99.9, defined with 0.1 sec. resolution. Unit of this parameter is set by **"unit"** parameter.

"toFF" - turn off delay time, the relay is turned off with delay equal **"toFF"** if the input value exceeds appropriate ***border value*** (defined with ***threshold*** and ***hysteresis***), at least **"toFF"** time. **"toFF"** range 0 ÷ 99.9, defined with 0.1 sec. resolution. Unit of this parameter is set by **"unit"** parameter.

If time when the input signal exceeds some border value is shorter than **"t on"** or **"toFF"** time, the relay do not change his state (see paragraph: ***CONTROL OF THE RELAY OUTPUTS***).

"unit" - unit of time for **"t on"** i **"toFF"** parameters. Can be set on one of two values:

"min" - minutes,
"SEC" - seconds.

"AL"- This parameter defines the relay reaction when some critical situations occurs:

"noCH" - relay do not change his state,
"on" - relay will be turned on,
"oFF" - relay will be turned off.

- If option "**noCH**" is selected for **"AL"** parameter, behaviour of the relay may depend on "**FiLt**" parameter in some cases. If "**FiLt**" is set to big value and the input current drops, result value of the measure will change slow, causes of turning on or off relay due to thresholds values. The critical situation is slowly detected, so it is not possible to predict the relay state in that situations.
- If parameter „**AL**" = „**on**", the relay will be turned on in the critical situations, even if his parameter ***"modE" = "noAC".***

7.3.2. "inPt" menu

This menu presets the measurement input:

"**tYPE**" - type of the input / sensor. This parameter can be set to values:

*"**0-20**", "**4-20**"* - current inputs of 0÷20mA or 4÷20mA of measurement range respectively. Displayed values are defined by parameters **"Lo C"**,**"Hi C"** (or by user defined characteristic points) and parameter **"Pnt"**.

"CHAr" - this option presets type of the conversion characteristic, and can be set to

"Lin"	- linear	When one of those characteristics is chosen display range is defined by **"Lo C"** and **"Hi C"**.
"Sqr"	- square	
"Sqrt"	- square root	

"5 Pt"	User defined characteristic. This characteristic is defined by 5, 10 or 20 segments, respectively of selected option. Range of displayed values is defined using "**Lo C**", "**P 0.05**" ... "**P 0.95**", "**Hi C**" parameters.
"10Pt"	
"20Pt"	

The process of displayed result calculation is described in details in ***DISPLAY VALUES CALCULATION*** paragraph.

"FiLt" - this parameter sets filtration rate. It can be set to values from 0 (no filtration) to 5 (strongest filtration – time window about 2 sec).

"Pnt" - decimal point position. It can be set to one of:
" 0", " 0.0", " 0.00", "0.000"
Decimal point position is changed by **[^]**, **[v]** buttons.

"Lo C"
"P0.05"
:
:
"P0.95
"Hi C"

These parameters describe the displayed values, referred to different measurement results. If input type is set to 4-20 mA (0-20mA) **"Lo C"** parameter defines the value displayed when input current is equal 4 mA (0mA), and **"Hi C"** parameter defines the value displayed for 20 mA of input current.

Options like **"P 0.XX"** define value displayed, while measurement result is equal to particular percentage value of selected measurement range, for example: if range is 4-20 mA, parameter **"P 0.30"** defines value displayed while current is equal to 8,8 mA.

Particular options **"P 0.XX"** are available (in menu) only while specific user characteristic is selected. E.g. when user characteristic uses 5 segments then only **"Lo C"**, **"P 0.20"**, **"P 0.40"**, **"P 0.60"**, **"P 0.80"** and **"Hi C"** are available.
If linear, square or square root characteristic is selected, then parameters **"Lo C"** and **"Hi C"** are only available.

All mentioned parameters can be set in range -999 ÷ 9999. Negative values can be set by entering **'-'** sign on the first position (by use of **[^]**, **[v]** buttons).

"Lo r", **"Hi r"** - These parameters define the expansion of nominal range in percent. They determine the permissible range of input currents (Figure7.1).

The permissible range allow user to exceed the nominal range of input current. If input value is contained in the permissible range a proper result is displayed. If input current exceeds this range (defined by **"Lo r"** and **"Hi r"**), **"-Lo-"** or **"-Hi-"** warning is displayed depend on input current value.

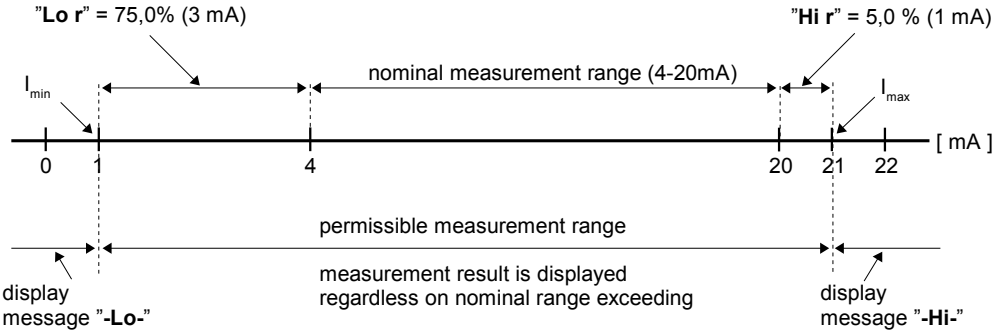


*Figure 7.1 Example of definition of permissible range of input currents - "**Lo r**" and "**Hi r**" parameters (**"4-20"** mode)*

The **"Lo r"** parameter is important if input is set to **"4-20"** mode only, and determines lower border of the permissible range. If input is set to **"0-20"** mode, lower border of the permissible range is always 0mA.
If input is set to **"4-20"** mode, the lower border is calculated due to expression:

$$I_{min} = 4\ mA - 4\ mA \times \textbf{"Lo r"}\ \%.$$

The **"Lo r"** value can be set from 0 to 99.9%.
Parameter **"Hi r"** determines the upper border of the permissible range accordingly to the expression (for both **"0-20"**i **"4-20"**modes):

$$I_{max} = 20\ mA + 20\ mA \times \textbf{"Hi r"}\ \%.$$

The value of **"Hi r"** can be set from 0 to 19.9%

In example no 1 of the ***DISPLAY VALUES CALCULATION*** paragraph the procedure of the permissible input range determining is presented in details.

7.3.3. "SECu" menu

This menu contains presets connected with availability of other parameters :

"AccE" - this option permits user (**"on"**) or prohibits (**"oFF"**) to modify the thresholds of the relays without knowledge about user password (see: ***MEASUREMENT MODE***).

"Scod" - user password (4-digits number). If this parameter is set at value **"0000"**, user password is turned off.

If the user do not remember his password, the access to the menu is possible by the "one-use password". To get this password please contact witch Marketing Division. Please set new user password immediately after use of the "one-use password" - see "Scod" parameter.

The "one-use password" can be used one time only, it is impossible to use it again! The "one-use password" can be restored by Service Division only.

7.3.4. "rS" menu

This menu is connected with RS-485 interface, and sets his properties:

"Addr" - this parameter defines the address of the device, accordingly to Modbus protocol. It can be set in range from 0 to 199. If the value 0 is set then device, responds to frames with address 255 (FFh).

"bAud" - this parameter determines RS-485 interface baud rate. It can be set to one of 5 possible values: **"1.2"**, **"2.4"**,**"4.8"**, **"9.6"**, **"19.2"**, which respond to the baud rates of 1200, 2400, 4800, 9600, 19200 bit/s respectively.

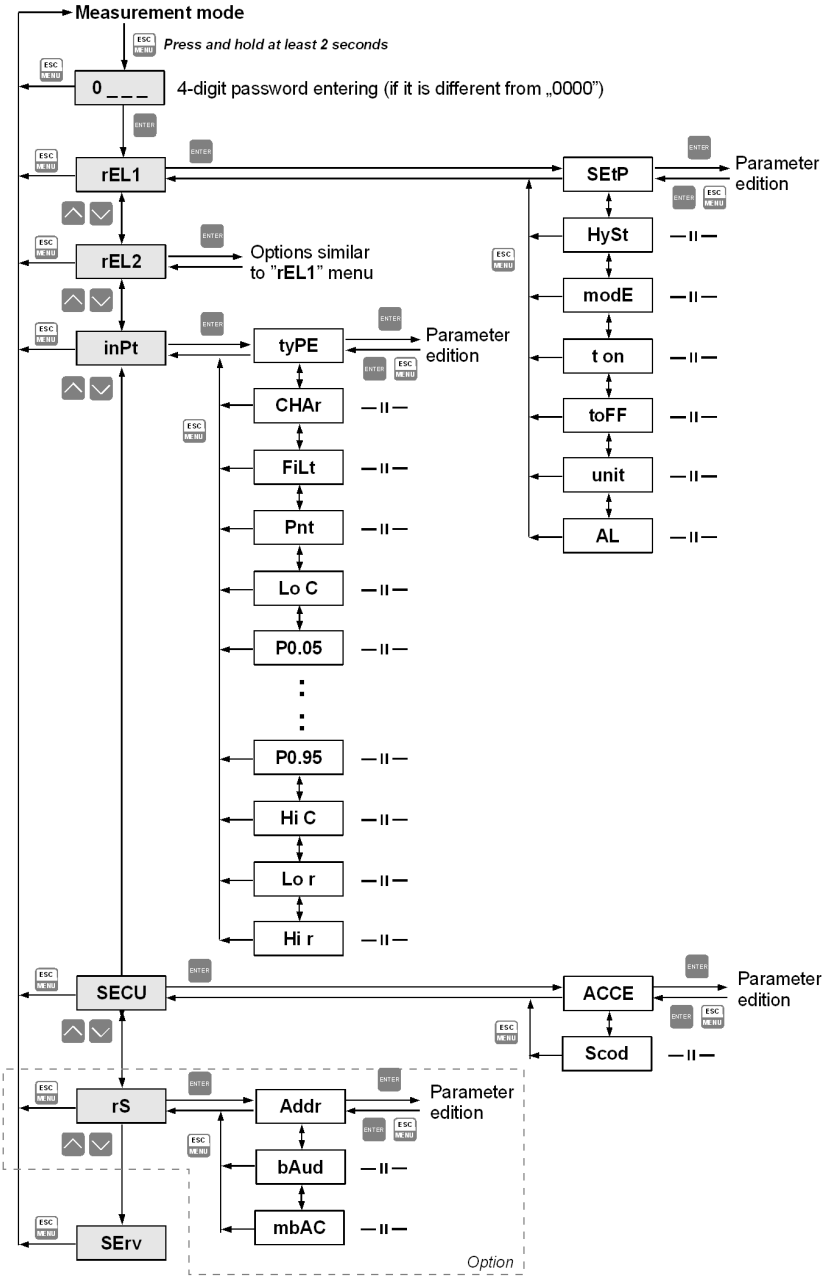
"mbAc" - this parameter sets the access to the configuration registers of the device. Possible values:
"on" - configuration registers can be set via RS-485 interface,
"oFF" - configuration registers can not be set via RS-485 interface.

The access to registers no 02h cant be denied by **"mbAc"** parameter (see: ***LIST OF REGISTERS***).

7.3.5. "SErv" menu

This menu contains the parameters for authorized service only. To enter this menu proper service password must be entered. Improper settings can causes of damage of the device.

7.4. MENU STRUCTURE



8. THE ALARM LED

The *ALARM LED* (AL) is turned on when input current is out of the permissible input range. See parameters: **"tyPE"**, **"Lo r"** and **"Hi r"** in paragraph ***„InPt" menu***.

9. OVER-CURRENT PROTECTION

The input of the device is equipped with over-current protection circuit. This circuit protects the standard resistor to damage. Maximum input current is set to 35mA. Activity of protection is being signalised via message **"Hot"** on the display, and activation of alarm state in controller (relays in their alarm states, works accordingly to their settings **"AL"**).
When temperature of the standard resistor falls, the protection circuit will turn off himself automatically, and the device will measure the input current again. Due to thermal phenomenon in the standard resistor, precision of the measurement may be lower, during few minutes (up to the standard resistor temperature will falls to the environment temperature).

10. DISPLAYED VALUES CALCULATION

The first step to compute the result of measure is the calculation of the normalized result (it means result of 0-1 range). To do it, the begin of the input range (0 mA for 0-20mA range, and 4mA for 4-20mA range) must be subtracted from measured value. Next, received result must be divided by the width of the input range (it means 20mA for 0-20mA range, and 16mA for 4-20mA range). So normalized result can be expressed by expressions:

$$I_n = \frac{I_{inp.} - 4}{16} \qquad for \quad 4 \div 20 \ mA \quad range$$

$$I_n = \frac{I_{inp.}}{20} \qquad for \quad 0 \div 20 \ mA \quad range$$

where $I_{inp.}$ Means input current (in mA), and I_n – normalized result.

If measured value exceeds the nominal input range (0-20mA or 4-20mA), and do not exceed the permissible input range, then received normalized I_n result will exceed 0-1 range, e.g. input range 4-20 mA, input current = 3 mA – the normalized result is equal -0,0625, and for input current = 22 mA, the normalized result is equal 1,125. In such cases presented expressions are still correct.

10.1. ADDITIONAL CALCULATIONS (USED CONVERSION CHARACTERISTIC)

The manner of the additional computation of the displayed result depends on selected conversion characteristic. All presented charts are connected with the input range 4 - 20 mA.

10.1.1. Linear characteristic

The normalized result is converted by fixed coefficients determined by **"Lo C"** and **"Hi C"** parameters (when the normalized results is equal 0, then value **"Lo C"** is displayed, and when the normalized results is equal 1, then value **"Hi C"** is displayed). Expression presented below shows the manner of result calculation:

$$W = I_n \times ("Hi\ C" - "Lo\ C") + "Lo\ C",$$

where **W** means the displayed value.

The value of the **"Lo C"** parameter can be higher than the value of **"Hi C"** parameter. In such a case, for an increasing value of input current the displayed value decreases.

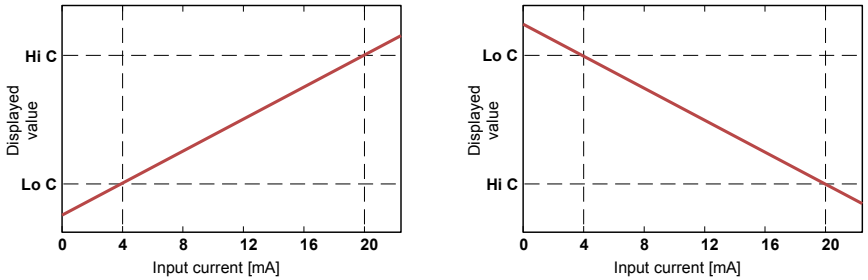


Figure. 10.1 Normal („Lo C" < "Hi C) and inverted („Lo C" > "Hi C) characteristic

10.1.2. Square characteristic

The normalized result is squared and further conversion is done as for linear characteristic. Conversion is made accordingly with the expression:

$$W = I_n^2 \times ("Hi\ C" - "Lo\ C") + "Lo\ C",$$

where **W** means the displayed value.

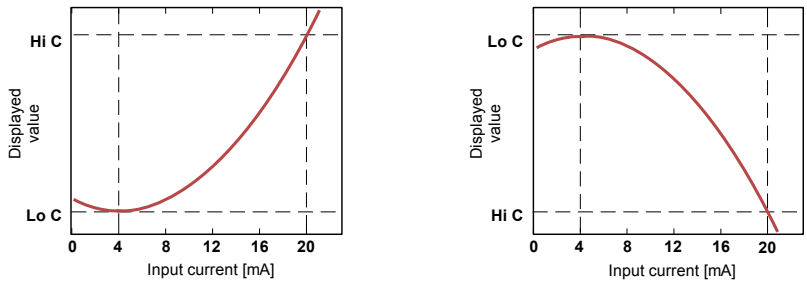


Figure. 10.2 Normal („Lo C" < "Hi C) and inverted („Lo C" > "Hi C) characteristic

10.1.3. Square root characteristic

The normalized result is rooted and further conversion is done as for linear characteristic. Conversion is made accordingly with the expression:

$$W = \sqrt{I_n} \times ("Hi\ C" - "Lo\ C") + "Lo\ C",$$

where W means the displayed value.

Showed above expression is not valid when normalized result is negative. It is possible for 4-20 mode only. In this case (I_n<0) the displayed result is equal **"Lo C"** (see graphs below).

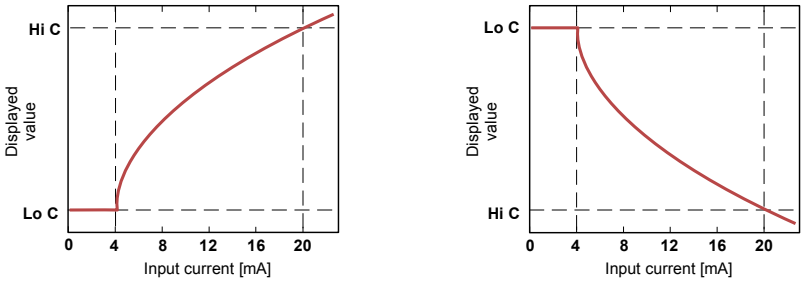


Figure. 10.3 Normal („Lo C" < "Hi C) and inverted („Lo C" > "Hi C) characteristic

10.1.4. User defined characteristic

User characteristics are defined by user using 5, 10 or 20 connected linear segments (it means using 6, 11 or 21 points – see graph). Due to the normalized result I_n , the device computes specific segment, e.g. for 10-segment characteristic and I_n = 0.65, the segment defined by points **"P 0.60"** and **"P 0.70"** will be chosen.
Let's mark those points as PL (point low) i PH (point high) - in this example PL= **"P 0.60,"** and PH = **"P 0.70."**, and the normalized result I_n for the point PL as I_p (in this example I_p = I_n(PL) = 0.6). The displayed result is calculated accordingly to the expression:

$$W = N \times (I_n - I_p) \times (PH - PL) + PL$$

where N mean number of segments (5, 10 or 20).

If the normalized result exceeds the user defined characteristic values, then specific utmost segment, defined by two next points, is used for calculations. If characteristic from figure below is used, and if I_n>1 then segment defined by points PL = **"P 0.80"** and PH = **"Hi C"** will be used (I_p = 0,8).

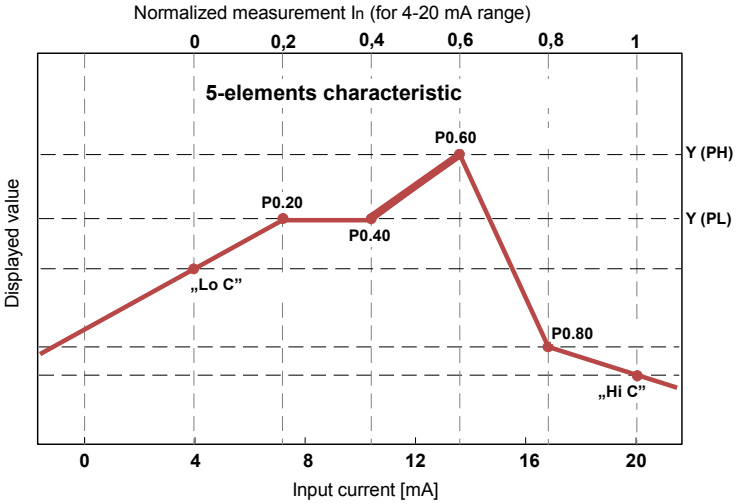


Figure. 10.4 Example of user defined characteristic

10.2. EXAMPLES OF CALCULATIONS

Example 1: Selection of the permissible input range (“4-20” mode)

If in “**4-20**” mode the user sets **“Lo r”** = 20,0% and **“Hi r”** = 10,0%, then permissible input currents range will be equal: 3,2 mA ÷ 22 mA. Lower border of the range is the result of calculations: 4 mA - 4 mA × 20%, and the higher : 20 mA + 20 mA × 10%.

Example 2: The normalized I_n result calculation

Let the input mode = 4-20 mA. The normalized I_n result is calculated accordingly to the expression on page 23, so if I_{in} = 10 mA then 10 mA - 4 mA = 6 mA, and this result should be divided by the width of input range (16 mA). Finally the normalized result: I_n = 6/16 = 0,375.

In case when input current exceeds nominal measurement range, calculations are similar. For example if input current is equal 2,5 mA then I_n = (2,5 - 4)/16 ≅ -0,0938, and if input current is equal 20,5 mA then I_n = (20,5 - 4)/16 ≅ 1,0313.

Example 3: The linear characteristic

Let the input mode = 4-20 mA, and parameters **“Lo C”** and **“Hi C”** equal to -300 and 1200 respectively. The calculations will be done for there different input currents from example 2.

a) I_{in} =10 mA and I_n = 0,375
Accordingly to expression on page 24 for linear characteristic:
0,375 × [1200 -(- 300)] ≅ 562 and next, the **"Lo C"** value is added to the result , so the displayed value:
W ≅ 562 + (-300) = 262

b) I_{in} = 2,5 mA and I_n = -0,0938.
W ≅ -441.

c) I_{in} = 20,5 mA and I_n = 1,0313.
W ≅ 1247.

***Example 4:* The square characteristic**

Let the input mode = 4-20 mA, and parameters **"Lo C"** and **"Hi C"** equal to -300 and 1200 respectively. The calculations will be done for there different input currents from example 2.

a) I_{in} =10 mA and I_n = 0,375
Accordingly to expression on page 24 for linear characteristic: $(0,375)^2$ × [1200 -(- 300)] ≅ 211. and next, the **"Lo C"** value is added to the result , so the displayed value:
W ≅ 211 + (-300) = -89

b) I_{in} = 2,5 mA and I_n = -0,0938.
W ≅ -287.

c) I_{in} = 20,5 mA and I_n = 1,0313.
W ≅ 1295.

***Example 5:* The square root characteristic**

Let the input mode = 4-20 mA, and parameters **"Lo C"** and **"Hi C"** equal to -300 and 1200 respectively. The calculations will be done for there different input currents from example 2.

a) I_{in} =10 mA and I_n = 0,375
Accordingly to expression on page 25 for linear characteristic:
sqrt(0,375) × [1200 -(- 300)] ≅ 919.
and next, the **"Lo C"** value is added to the result , so the displayed value:
W ≅ 919 + (-300) = 619

b) I_{in} = 2,5 mA and I_n = -0,0938 , normalized result is negative , so the displayed value is equal to **"Lo C"** parameter: W ≅ **"Lo C"** = -300.

c) I_{in} = 20,5 mA and I_n = 1,0313.
W ≅ 1223.

***Example 6:* The user defined characteristic**

Let the input mode = 4-20 mA, and the user selected the 10 segment characteristic. To do this it is necessary to enter **"Lo C"**, **"P 0.10"**, **"P 0.20"**, ..., **"P 0.90"**, **"Hi C"**. coordinates.
The calculations will be done for three different input currents from example 2, so in calculations some of the segments will be used only.

Let the following points will be given:
"Lo C" = -50,
"P 0.10" = -30,
....
"P 0.30" = 30,
"P 0.40" = 80,
...
"P 0.90" = 900,
"Hi C" = 820.

Additionally all other points must to be defined and stored in the device memory.

a) I_{in} =10 mA and I_n = 0,375

The segment defined by **"P 0.30"** and **"P 0.40"** for this I_n will be selected. Accordingly to expressions given for user defined characteristic (see page 25) PL = **"P 0.30"** = 30,
PH = **"P 0.40"** = 80 and I_p = 0,3 , the displayed value :

$$W = N \times (I_n - I_p) \times (PH - PL) + PL =$$
$$= 10 \times (0{,}375 - 0{,}3) \times (80 - 30) + 30 \simeq 67$$

b) I_{in} = 2,5 mA and I_n = -0,0938, because of the normalized I_n value is lower than 0, the segment defined by "Lo C" and "P 0.10" will be selected. PL = "Lo C" = -50,
PH = "P 0.10" = -30 and I_p = 0. For these values the displayed value W ≅ -69.

c) I_{in} = 20,5 mA and I_n = 1,0313. , because of the normalized I_n value is higher than 1, the segment defined by "P 0.90" and "Hi C" will be selected. PL = "P 0.90" = 900,
PH = "Hi C" = 820 and I_p = 0,9. For these values the displayed value W ≅ 795.

11. THE MODBUS PROTOCOL HANDLING

Transmission parameters: 1 start bit, 8 data bits, 1 stop bit, no parity control
Baud rate: selectable from: 1200 to 19200 bits/second
Transmission protocol: MODBUS RTU compatible

The device parameters and measurement result are available via RS-485 interface, as HOLDING-type registers of Modbus RTU protocol. The registers (or groups of the registers) can be read by 03h function, and wrote by 06h (single registers) accordingly to Modbus RTU specification. Maximum group size for 03h functions can not exceeds 5 registers (for single frame).

The device interprets the broadcast messages, but then do not sends the answers.

11.1. LIST OF REGISTERS

Register	*Write*	*Range*	*Register description*
01h	No	-999 ÷ 9999	Current measurement value (no decimal point)
02h	Yes	0 ÷ 7	State of the relays and alarm LED (binary format) (1 - on, 0 - off): **00000000 00000cba** **a** - relay R1; **b** - relay R2; **c** - alarm LED; If written, only **a**, **b** bits are important (others are ignored) these bits allows user to control the relays via RS-485 interface
04h	Yes	0 ÷ 1	"**tyPE**" parameter in "**InPt**" menu (nominal input range). **0** - 0-20 mA range; **1** - 4-20 mA range
05h	Yes	1 ÷ 6	"**CHAr**" parameter in "**InPt**" menu (characteristic type) **1** - linear ; **2** - 5-segments ; **3** - 10-segments ; **4** - 20-segments; **5** - square; **6** - square root;
06h	Yes	0 ÷ 5	"**FiLt**" parameter in "**InPt**" menu (measurement filtering rate)
07h	Yes	1 ÷ 4	"**Pnt** " parameter in "**InPt**" menu (decimal point position) **1** - " **0**"; **2** - " **0.0**"; **3** - " **0.00**"; **4** - "**0.000**"
08h	Yes	-999 ÷ 9999	"**Lo C**" parameter in "**InPt**" menu, no decimal point included
09h	Yes	-999 ÷ 9999	"**Hi C**" parameter in "**InPt**" menu, no decimal point included
0Ah	Yes	0 ÷ 999	"**Lo r**" parameter in "**InPt**" menu, in 0,1%
0Bh	Yes	0 ÷ 199	"**Hi r**" parameter in "**InPt**" menu, in 0,1%
10h	Yes	-999 ÷ 9999	"**SEtP**" parameter in "**rEL1**" menu, no decimal point included
11h	Yes	0 ÷ 999	"**HySt**" parameter in "**rEL1**" menu, no decimal point included

Register	*Write*	*Range*	*Register description*
12h	Yes	0 ÷ 3	"**modE**" parameter in "**rEL1**" menu (operation mode of R1 relay) **0** - no active; **1** - "**on**" mode; **2** - "**oFF**" mode; **3** - the relay controlled via RS-485 interface
13h	Yes	0 ÷ 999	**"t on"** parameter in **"rEL1"** menu, expressed in tenth of seconds or tenth of minutes depend on **"unit"** parameter - register no. 15h)
14h	Yes	0 ÷ 999	**"toFF"** parameter in **"rEL1"** menu, expressed in tenth of seconds or tenth of minutes depend on **"unit"** parameter - register no. 15h)
15h	Yes	0 ÷ 1	**"unit"** parameter in **"rEL1"** menu (the time unit of R1 relay); **0** - seconds; **1** - minutes
16h	Yes	0 ÷ 2	**"AL"** parameter in **"rEL1"** menu (the state of R1 relay, while critical situation occurs); **0** - no changes; **1** - on; **2** - off
18h	Yes	-999 ÷ 9999	"**SEtP**" parameter in "**rEL2**" menu, no decimal point included
19h	Yes	0 ÷ 999	"**HySt**" parameter in "**rEL2**" menu, no decimal point included
1Ah	Yes	0 ÷ 3	"**modE**" parameter in "**rEL2**" menu (operation mode of R2 relay) **0** - no active; **1** - "**on**" mode; **2** - "**oFF**" mode; **3** - the relay controlled via RS-485 interface
1Bh	Yes	0 ÷ 999	**"t on"** parameter in **"rEL2"** menu, expressed in tenth of seconds or tenth of minutes depend on **"unit"** parameter - register no. 1Dh)
1Ch	Yes	0 ÷ 999	**"toFF"** parameter in **"rEL2"** menu, expressed in tenth of seconds or tenth of minutes depend on **"unit"** parameter - register no. 1Dh)
1Dh	Yes	0 ÷ 1	**"unit"** parameter in **"rEL2"** menu (the time unit of R2 relay); **0** - seconds; **1** - minutes
1Eh	Yes	0 ÷ 2	**"AL"** parameter in **"rEL2"** menu (the state of R2 relay, while critical situation occurs); **0** - no changes; **1** - on; **2** - off
20h[1]	Yes	0 ÷ 199	Device address
21h	No	00A7h	Device identification code (ID)
22h[2]	Yes	0 ÷ 4	**"bAud"** parameter in **"rS"** menu (baud rate); **0** - 1200 baud; **1** - 2400 baud; **2** - 4800 baud; **3** - 9600 baud; **4** - 19200 baud
23h[3]	Yes	0 ÷ 1	**"mbAc"** parameter in **"rS"** menu (permission to write registers via RS-485 interface); **0** - write denied ; **1** - write allowed
24h	Yes	0 ÷ 1	**"AccE"** parameter in **"SECU"** menu (permission to change of the thresholds without knowledge of the user password); **0** - changes denied; **1** - changes allowed
38h	Yes	-999 ÷ 9999	"**Lo C**" parameter in "**inPt**" menu, no decimal point included (copy of 08h register)
39h	Yes	-999 ÷ 9999	"**P0.05**" parameter in "**inPt**" menu, no decimal point included
3Ah	Yes	-999 ÷ 9999	"**P0.10**" parameter in "**inPt**" menu, no decimal point included
.	.	.	.
.	.	.	.
.	.	.	.
4Bh	Yes	-999 ÷ 9999	**"P0.95"** parameter in **"inPt" menu,** no decimal point included

Register	*Write*	*Range*	*Register description*
4Ch	Yes	-999 ÷ 9999	"**Hi C**" parameter in "**inPt**" menu, no decimal point included (copy of 09h register)

1 - after writing to register no 20h the device responds witch an "old" address in the message.
2 - after writing to register no 22h the device responds with the new baud rate.
3 - the value of the "**mbAc**" parameter is also connected to write to this register, so it is possible to block a writes, but impossible to unblock writes via RS-485 interface, The unblocking of the writes is possible from menu level only.

11.2. TRANSMISSION ERRORS DESCRIPTION

If an error occurs while write or read of single register, then the device sends an error code according to Modbus RTU specifications (example message no 1).

Error codes:
01h - illegal function (only functions 03h, 06h and 10h are available),
02h - illegal register address
03h - illegal data value
08h - no write permission (see: "**mbAc**" parameter)
A0h - exceed of upper border of input range
60h - exceed of lower border of input range

A0h and 60h codes can appear only during reg. 01h is reading by 03h function (read of a single register).

11.3. EXAMPLES OF QUERY/ANSWER FRAMES

Examples apply for device with address 1. All values are represent hexadecimal.

Field description:
ADDR Device address on modbus network
FUNC Function code
REG H,L Starting address (address of first register to read/write, Hi and Lo byte)
COUNT H,L No. of registers to read/write (Hi and Lo byte)
BYTE C Data byte count in answer frame
DATA H,L Data byte (Hi and Lo byte)
CRC L,H CRC error check (Hi and Lo byte)

1. Read of the displayed value (measurement), the device address = 01h:

ADDR	FUNC	REG H,L		COUNT H,L		CRC L,H	
01	03	00	01	00	01	D5	CA

a) The answer (we assume that input current is not out of range):

ADDR	FUNC	BYTE C	DATA H,L		CRC L,H	
01	03	02	00	FF	F8	04

DATA H, L - displayed value = 255, no decimal point. Decimal point position can be read from reg. 07h.

b) The answer (if an error occur):

ADDR	FUNC	ERROR	CRC L,H	
01	83	60	41	18

ERROR - error code = 60h, bottom border of the measurement range is exceeded

2. Read of ID code

ADDR	FUNC	REG H,L		COUNT H,L		CRC L,H	
01	03	00	21	00	01	D4	00

The answer:

ADDR	FUNC	BYTE C	DATA H,L		CRC L,H	
01	03	02	00	A7	F9	FE

DATA - identification code (00A7h)

3. Change of the device address from 1 to 2 (write to reg. 20h)

ADDR	FUNC	REG H,L		DATA H,L		CRC L,H	
01	06	00	20	00	02	09	C1

DATA H - 0
DATA L - new device address (2)

The answer (the same as the message):

ADDR	FUNC	REG H,L		DATA H,L		CRC L,H	
01	06	00	20	00	02	09	C1

4. Change of baud rate of all devices connected to the net (BROADCAST message).

ADDR	FUNC	REG H,L		COUNT H,L		CRC L,H	
00	06	00	22	00	04	29	D2

DATA H - 0
DATA L - 4, new baud rate 19200 baud

Device do not reply to BROADCAST-type messages.

5. Read of the registers 1 and 2 in one message (example of writing a number of registries in one frame):

ADDR	FUNC	REG H,L		COUNT H,L		CRC L,H	
01	03	00	01	00	03	54	0B

COUNT L - the count of being read registers (max. 5)

The answer:

ADDR	FUNC	BYTE C	DATA H1,L1		DATA H2,L2		CRC L,H	
01	03	04	00	0A	00	01	1B	F1

DATA H1, L1 - reg. 01h (10 - displayed value ”1.0”),,
DATA H2, L2 - reg. 02h (0 - relay R1 closed),,

There is no full implementation of the Modbus Protocol in the device. The functions presented above are available only.

12. DEFAULT AND USER'S SETTINGS LIST

Parameter	*Description*	*Default value*	*User's value*	*Desc. page*
Parameters of relay R1 operation ("rEL1" menu)				
SEtP	Relay R1 threshold	6.50		17
HYSt	Hysteresis of relay R1	0.00		17
modE	Operation mode of relay R1	on		18
t on	Turn on delay of relay R1	0.1		18
toFF	Turn off delay of relay R1	0.1		18
unit	Unit of **"t on"**, **"toFF"** parameters of relay R1	SEC		18
AL	Reaction for critical situation of relay R1	oFF		18
Parameters of relay R2 operation ("rEL2" menu)				
SEtP	Relay R2 threshold	9.50		17
HYSt	Hysteresis of relay R2	0.00		17
modE	Operation mode of relay R2	on		18
t on	Turn on delay of relay R2	0.1		18
toFF	Turn off delay of relay R2	0.1		18
unit	Unit of **"t on"**, **"toFF"** parameters of relay R2	SEC		18
AL	Reaction for critical situation of relay R2	oFF		18
Configuration of measurement input ("inPt" menu)				
tYPE	Input mode	„4-20"		19
CHAr	Conversion characteristic mode	Lin		19
FiLt	Filtering ratio	0		19
Pnt	Decimal point position	0.00		19
Lo C	Minimum displayed value (for nominal range)	4.0		19
P0.05	Value displayed for selected point of user characteristic	0.00		19
P0.10	see above	0.00		19
P0.15	see above	0.00		19
P0.20	see above	0.00		19
P0.25	see above	0.00		19
P0.30	see above	0.00		19
P0.35	see above	0.00		19
P0.40	see above	0.00		19
P0.45	see above	0.00		19

Parameter	***Description***	***Default value***	***User's value***	***Desc. page***
P0.50	see above	0.00		19
P0.55	see above	0.00		19
P0.60	see above	0.00		19
P0.65	see above	0.00		19
P0.70	see above	0.00		19
P0.75	see above	0.00		19
P0.80	see above	0.00		19
P0.85	see above	0.00		19
P0.90	see above	0.00		19
P0.95	see above	0.00		19
Hi C	Maximum displayed value (for nominal range)	20.00		19
Lo r	Extension of the bottom of the nominal input range	5.0 (%)		20
Hi r	Extension of the top of the nominal input range	5.0 (%)		20
Settings of access to the configuration parameters (“SECu” menu)				
AccE	Permission to changes of relays thresholds without of the user password knowledge	oFF		21
RS 485 interface configuration (menu “rS”)				
Addr	Device address	0		21
bAud	Baud rate	9.6		21
mbAc	Blocking of access to the configuration registers	on		21